



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 10, Issue, 03(C), pp. 31339-31343, March, 2019

**International Journal of
Recent Scientific
Research**

DOI: 10.24327/IJRSR

Research Article

DIET ANALYSIS OF GAUR, BOS GAURUS (SMITH, 1827) BY MICROHISTOLOGICAL ANALYSIS OF FECAL SAMPLES IN GOMARDA WILDLIFE SANCTUARY, RAIGARH, AND CHHATTISGARH, INDIA

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DOI: <http://dx.doi.org/10.24327/ijrsr.2019.1003.3240>

ARTICLE INFO

Article History:

Received 4th December, 2018
Received in revised form 25th
January, 2019
Accepted 18th February, 2019
Published online 28th March, 2019

Key Words:

Gaur, Gomarda, Wildlife Sanctuary,
feeding habits.

ABSTRACT

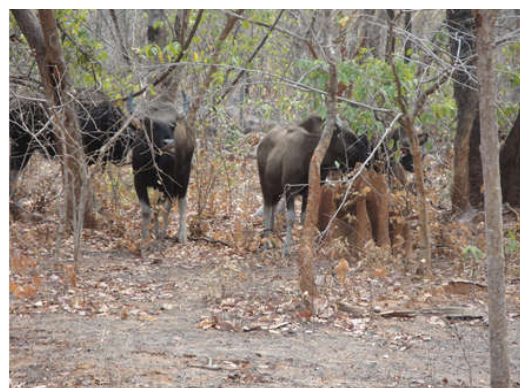
The Indian Bison (IB), *Bos gaurus* is one of the largest bovid and prevailing herbivore wild animals of Indian. Indian Bison has been listed as vulnerable on the IUCN red list since 1986. It is considered as the parental stock for domestic cattle. This paper aims to explore diet composition as well as seasonal variations in plants consumption of Indian Bison. This study mainly focuses on, food plants species and feeding habits of IB from November 2014 to June 2016 using direct observation and Sampling method and Fecal analysis. The Indian Bison in Gomarda Sanctuary feeds on diverse species of food plants comprising of 45 species belonging to 21 families. These food plants are represented by 17 species of grasses, 6 species of herbs, 5 species of shrubs and 17 species of trees. The Indian Bison does not prefer any diet in particular and it varies according to the season.

The major food plant species of IB in GS, nearly 37.77%, belong to Poaceae family. Unlike other Indian Bison in other geographical areas of India, IB in GS primarily feeds on young shoots, bark, flowers and fruits showing higher preference for grasses of different varieties. Gomarda, therefore, may be identified as the ideal destination for I.B.

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INTRODUCTION

Food is measured as the most essential component for the growth of all living organisms. The Indian Bison (IB) or *Bos gaurus* is one of the large wild ungulates. The gaur is a huge and dominant herbivore. It remains as an important link of the food chain of Indian forests. Large grassy areas and forested hills provide comfortable habitat to Indian bison. Indian bison are found on the forested hills and grassy areas. The periphery of the moist deciduous and deciduous forest which remain green throughout the year provide a congenial habitat to Indian Bison. As ecosystem landscapers, gaur play an important role in the moist and dry deciduous forests in India (Sankark.2013). Global distribution of Indian Bison



IB in Gomarda

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mainly covers countries like Nepal, Bhutan, Myanmar, Burma, China, Bangladesh, Cambodia, Peninsular Malaysia, Thailand and Vietnam (IUCN). The climate of the habitat where IB spread have almost the same characteristics. Apart from IB the Gomarda Wild Life Sanctuary is inhabited by a variety of wild life like Blue Bull, Sambar, Panther, spotted deer, Hyena, wild dog, deer and boar etc. This paper attempts to describe the food habits of Gaur through direct field observations and Fecal analysis from Nov 2014- June 2016 Gomarda Wild Life Sanctuary Sarangarh, district Raigarh, India. The park is part of Raigarh forest, Chhattisgarh; it is 52 km from Raigarh. Knowledge of diet composition is essential to take management decisions for viable population maintenance in the wild (Chatri 2006).

Gaur in India is found in 124 protected areas, which cover only 26 per cent of actual distribution area of gaur (Ashokkuma M. 2011). India accommodates the highest percentage of IB population, approximately 85% of its current global population (Nayak B. Kumar 2015). The estimated population is to be 13,000 to 30,000 with approximately 85 per cent of population being present in India (Ashokkuma M. 2011). Similar studies have been done by other scholars on IB. A few of them are:

Nutritional ecology of the ruminants documented by Van Soest P.J. (1982). 2 Food habits of ungulates in dry tropical forests of Gir lion sanctuary, Gujarat, studied by Khan, J. A. (1994). 3. ecology of wild ungulates of Keoladeo National Park, Bharatpur documented by Haque, N. 1990. 4. Distribution and conservation of Gaur studied by Chaudhary (2002). 5 Food habits of gaur and livestock (cows and buffaloes) in Paras Wildlife Reserve, central Nepal (2006). 6 Diet analysis of Gaur, *Bos gaurus gaurus* by microhistological analysis of fecal samples by Chatri. 7, Diet Composition and Quality in Indian Bison (*Bos gaurus*) Based on Fecal Analysis reported by Gad S.D., Soorambail K.S., (2011). 8. Quality of the food and diet composition in Indian Bison based on fecal analysis in Mookambika wild life sanctuary, Karnataka, studied by Prashanth PK.M. et. al. (2013). 9 Food and Feeding habits of Indian Bison, in Kuldiha Wildlife Sanctuary, Balasore, Odisha, India and its Conservation studied by Nayak (2015). 10 Food and Feeding Habits of Gaur (*Bos gaurus*) in Highlands of Central India, documented by Haleem A., et.al (2018).

Study Area

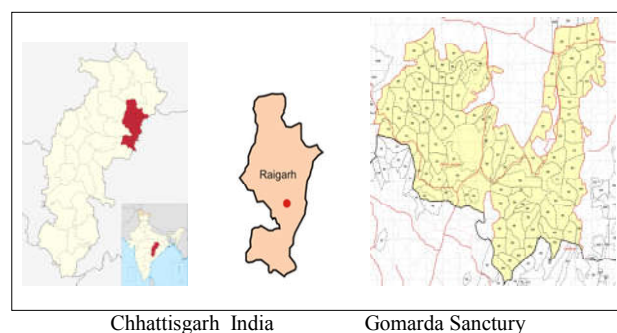
The Gomarda wildlife sanctuary, established in 1983, is situated in the central part of India at Sarangarh tehsil of district Raigarh, Chhattisgarh and spreads from 21°-22' to 21° - 38' North latitude and 83° - 26' to 83° - 15' East longitude. The temperature of the place ranges from 7° c. (minimum) to 43° c (maximum) and the rainfall is generally registered 1300 mm annually. The protected area where IB inhabits covers moderately dense forest and hilly terrain of 277.82 Km of forest. The temperature and the rainfall help in growing grass, plant and other vegetation essential for the survival of IB. Two rivulets "latnala" and "manainala" crisscross the Sanctuary and supply sufficient water to two waterfalls "Adharpani" and "Khapan" that are preferred destinations of IB within the Sanctuary. The hilly landscape with ups and down is marked with moderate to steep slopes within the range of 100 to 300 meter altitudes. The maximum and minimum Relative Humidity is 88% and 62% respectively. The habitat of Gaur is

characterized by unevenly distributed forest tracts and hilly terrain down with an altitude of 1500-1800 m, abundant forage in the form of grass including bamboo, shrubs and trees. (Chaudhary 2002).

The sampling of the vegetation for this study was done in summer, winter, and post monsoon as the Sanctuary remains closed for human activity during monsoon



IB in Gomarda



Chhattisgarh India

Gomarda Sanctuary

Study Area

RESULT

This study concludes that the diet of the Bison consists of diverse species of food plants consisting of 45 plant species that include 17 trees, 06 herbs, 17 grasses, and 05 shrubs. (Table 1). This study shows that the gaur is primarily intermediate or adaptable mixed feeders. Minute analysis shows that the food plants of Bison consist of diverse species of plants (45 plants species). On an average, grass formed major proportion of their feed (41.66%), equal to tree (41.66%), followed by herb (13.33%), and shrubs (11.11%). I observed and found that the Indian Bison of Gomarda wildlife sanctuary feeds on diverse species of food plants comprising of 45 species of plants belonging to 21 families (table-1). The food plants of IB were represented by 17 species of grasses, 6 species of herbs, 5 species of shrubs and 17 species of trees with preference for grass species and leaves. The diet of the Gaur varies with the

change of the season. My study shows that Shrubs become indispensable for feed during autumn because there is scarcity of other plants and grasses preferred by bison. Due to availability of food and water throughout the year, the Gomarda area of sarangarh accommodates the maximum number of bison populations of central India.

METHODS

Direct observation and Fecal Analysis have been used to explore Diet composition and its quality in Indian Bison.

Direct Observation: I visited the habitat at the dawn and in the evening innumerable times with my binocular to observe the feeding activity of gaur to collect plant species on which they fed. For the task of identifying the plant species, I sat hours together with taxonomists.

Faecal analysis: This analysis is done through Satakopan (1972) method. Collecting the dung samples was an arduous task, as I had to follow the route of the Gaur throughout the year excepting rainy season. Once the samples were collected, I dried them separately in sun. The dried samples were washed in chloral hydrate solution and boiled separately in about 3–4 ml of chloral hydrate solution for a few minutes, repeating the process several times and left to cool and settle down. After it settled down the pallets were retained and passed through grades of alcohol: xylol mixtures (alcohol: xylol; 3:1, 1:1, 1:3). Finally mounting was done in DPX. Slides of fecal material were studied under microscopes at a magnification of 100X.

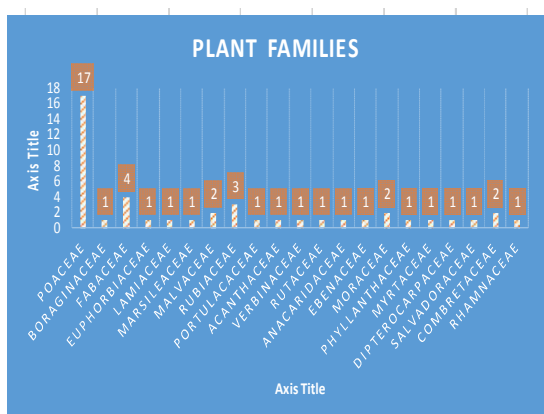
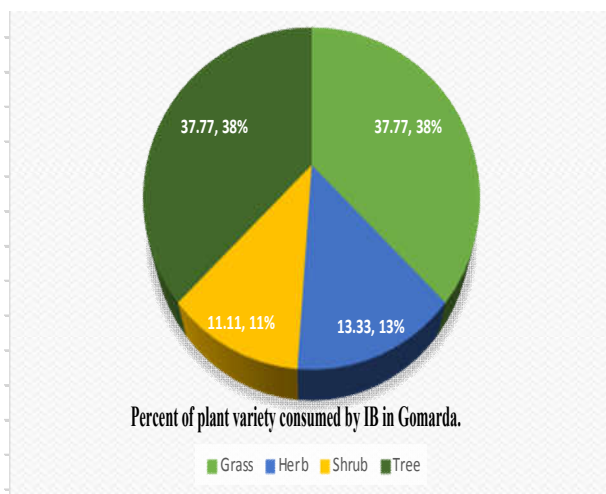
Forty-five plant species were selected for the preparation of reference slides. It was observed and ascertained that these were the plants that were eaten by the Gaur. To complete the process, I prepared sections of stems and the upper and lower epidermis of leaves of all different plant species separately. Permanent slides of the plant fragments obtained were prepared. The reference slides were studied in context of histological features e.g. cell wall structure, shape and size of stomata, hairs and trichomes. The Identification of plant fragments was based on keys given by Satakopan (1972). I compared the slides of plant fragments with feces material slides and the results thus obtained were compared with field observations. I found that the features of the feces were related to changes in phenology.

List of food plant species consumed by Indian Bison in Gomarda Sanctuary, sarangarh, RAIGARH, CG

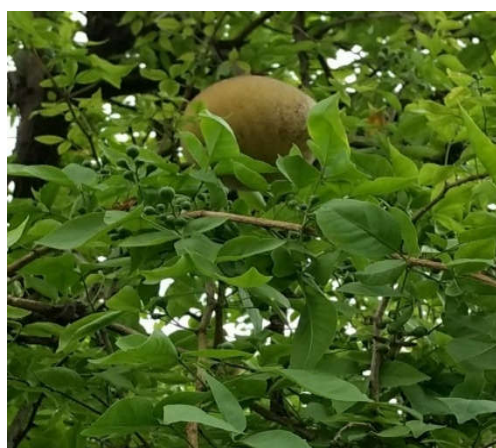
Family	Species	Plant parts eaten	Seasonal Distribution		
			Post monsoon	Winter	summer
GRASS			-	-	
Poaceae	Aristida setacea	S	-	-	+
Poaceae	Bambusa arundinacea	S,L	+	+	+
Poaceae	Bothriochloa pertusa	S,L	+	+	-
Poaceae	Cenchrurus sp.	S,L	+	+	+
Poaceae	Chrysopogon aciculatus	S	+	-	-
Poaceae	Cynodon dactylon	S,L	+	+	+
Poaceae	Cyperus rotundus	S,L	+	-	-
Poaceae	Dendrocalamus	L,S	+	+	+

		strictus				
Poaceae	Dichanthium annulatum	L,S	+	+	-	
Poaceae	Fimbristylis mliiaceae	S	+	-	-	
Poaceae	Heteropogon contortus	S	+	+	-	
Poaceae	Panicum maximum	S	+	+	-	
Poaceae	Parapholis incurva	S,L	+	+	-	
Poaceae	Paspalum scrobiculatum	S,L	+	+	-	
Poaceae	Saccharum spontaneum	S	+	+	+	
Poaceae	Saccharum munja	L	+	+	-	
Poaceae	Vetivera zizanioides	S	+	-	-	
HERBS						
Fabaceae	Cassia tora	L	-	+	+	
Boraginaceae	Cordia obliqua	L	+	+	-	
Euphorbiaceae	Euphorbia hirta	L	-	-	+	
Lamiaceae	Leucas aspera	L	+	+	-	
Marsileaceae	Marsilea minuta	L,S	+	+	-	
Malvaceae	Urena lobata	L	+	+	-	
SHRUB						
Rubiaceae	Gardenia latifolia	L	+	+	+	
Fabaceae	Mimosa pudica	L	+	+	-	
Portulacaceae	Portulaca oleracea	L,S,F	+	+	+	
Acanthaceae	Strobilanthes auriculatus	L	+	+	-	
Verbinaceae	Pania	L	+	+	-	
TREES						
Rubaceae	Vitex negundo	L	+	+	-	
Rubaceae	Adina cordifolia	L	-	+	+	
Rutaceae	Aegle marmelos	L, F.	+	+	+	
Anacardidaceae	Anacardium occidentale	F.	-	-	+	
Fabaceae	Bauhinia racemosa	L	-	+	+	
Fabaceae	Cassia fistula	F	-	-	+	
Ebenaceae	Diospyros melanaxylon	Fr.	-	-	+	
Moraceae	Ficus glomerata	Fr.	-	-	+	
Malvaceae	Grewia tilifolia	L	+	+	+	
Phyllanthaceae	Phyllanthus emblica	F	-	+	+	
Moraceae	Morus alba	L	+	+	+	
Rubiaceae	Mitragyna parvifolia	L,F	-	-	+	
Myrtaceae	Syzygium cumuni	L,f.	+	+	+	
Dipterocarpaceae	Shorea robusta	L	-	+	+	
salvadoraceae	Salvadora persica	L,F	+	+	+	
Combretaceae	Terminalia arjuna	L	-	+	+	
Combretaceae	Terminalia chebula	LF	-	+	+	
Rhamnaceae	Zizyphus mauritia	L	+	+	+	

L =Leave, S =stem, Fr =fruit. F=Flower



Plant Families Consumed by IB in Gomarda



Aegle marmelos

DISCUSSION

My findings show that the diet of the Bison in Gomarda wildlife sanctuary consists of diverse species of food plants, similar to results obtained from studies in Mollen National Park Goa (Gad D. S. 2009) and Kuldiha Wildlife Sanctuary, Balasore, Odisha, India (Nayak B.K.). In contrast some researcher observe (Haleem A., 2018) that gaur is primary grass eaters. My Field Observation discloses that the gaur consumes 45 plant species. (17 species of grass, 5 species of shrub, 6 species of herb and 17 species of tree and others.) In post monsoon and winter, they feed preferably on fresh grasses

(*Cynodon dactylon*) and herb species of the *Cassia tora*. Mostly Gaur prefers small terrain for feeding and their peak feeding hours are in morning and evening. During mid-hours of the day they rest under tall trees. After sunset bison heard returns to selective terrains for night rest.

Wild gaur grazes and browses on a wider variety of plants and prefers the upper portions of plants, such as leaf blades, stems, and flowers. Indian bison is an herbivores animal and feeds on grasses, herbs and shrubs, with high preference for grasses and leaves in post monsoon. During winter they feed on grasses, leaf bladder and soft stems while in summer they feed on leaves, soft stems as well as dry grasses, fallen leave, fruits (mostly *Ficus glomerata*, *Syzygium cumuni*) and bark. Bison are year round grazers and primarily they on grasses, but when food is scarce, they also eat vegetation such as leaves, bladder and soft stems etc. Bison requires water every day and they lick salt after drinking water, if available. Artificial salt rocks are erected to provide salt to Indian Bison in Gomarda Wildlife Sanctuary, Raigarh.

Acknowledgments

This study could be possible because of the generous help of the Forest Department of Gomarda. The official of Sarangarh circle as well as the officers and other staff of the forest division extended tremendous help to me to visit the specific terrain that were required for this study. I also acknowledge the help I receive from other persons who helped me to make this study meaningful.

CONCLUSION

Based on its feeding habits, I conclude that gaur are primarily intermediate or adaptable mixed feeders (Classification by Hofman, 1973). They consume a wide variety of grasses, herbs, shrubs. They modify their diet as per the availability of food in different seasons. Rich flora of the Gomarda Wild Life Sanctuary makes it an ideal habitat for gaur.

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How to cite this article:

Anita Pandey., 2019, Diet Analysis of Gaur, *Bos Gaurus* (smith, 1827) by Microhistological Analysis of fecal Samples in Gomarda Wildlife Sanctuary, Raigarh, and Chhattisgarh, india. *Int J Recent Sci Res*. 10(03), pp. 31339-31343.
DOI: <http://dx.doi.org/10.24327/ijrsr.2019.1003.3240>
